



Southwest Georgia Interstate Study

Technical Memorandum

Future Year Trip Table Development

1.0 Introduction

The purpose of this memorandum is to document the procedure used to develop 2040 future year passenger and truck trip tables. These trip tables were developed from the base year 2006 trip tables that were the output from matrix estimation process in which the input seeds trip tables were refined and adjusted according to the existing ground traffic counts. The seeds trip tables include the passenger car and truck trip tables. The seeds truck table reflect both short-distance commercial truck trips and long-distance freight trips. The seeds passenger car trip table as well as the commercial truck trip table were created from trip generation and distribution steps in the travel demand model. The seeds table for freight was developed from the FHWA's FAF² database for 2006. The development of these seeds trip tables are documented in separated technical memorandum.

The future year trip tables were created by applying growth factors on these base year trip tables. The growth factor for passenger car and commercial truck tables were developed from the change in base and future year SE data while the growth factor for freight trip table was obtained from the FAF² database. The development of future year SE data is documented in the SE data Tech Memorandum. The growth factor was applied on the passenger car and commercial trip tables using the Fratar method. On the other hand, since the FAF² database provides base year the projected future year O-D freight flows, the growth factors for freight were calculated and applied on the O-D pair basis.

1.1 Passenger Car Trip Table Forecast

Two elements are required to develop the future passenger car trip tables. One is the base year trip table, and the other is the zonal growth factor that represents the changes in social-economic activity that occurs within the zones during the forecasted period. The zonal growth factors are used to apply onto the base year passenger car table using the Fratar method. The resulting trip table contains the estimated future year trips that reflect the change in growth at zonal level. The base year passenger car trip table is the output trip table from the matrix estimation process that takes the input seeds trip table and refines it according to the ground traffic count and trip length distribution of the seeds table. The seeds table is the output from the Southwest Georgia Interstate Study travel demand model that includes trip generation and trip distribution model components. The trip generation model estimates the total trips according to the SE data, while the trip distribution model allocates the trips between zones based on the travel impedance between the zone pair. The detailed procedure of model application is presented in the memorandum for Model Development.



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The growth factor primarily depends on the zonal change in SE data between the base year and future year. Changes in SE data at zonal level reflect the change in the economic activity in the zones, which in turn affect the number of daily trips generated by the zones. The TAZs of the travel demand model are organized into the five (5) different buffer layers, each with distinct zonal characteristics. Therefore, it was decided that zonal growth forecast should be performed according to specific buffer layer. The growth factors for zones within each buffer layer were developed using the zonal data from that buffer layer. For each buffer layer, a linear equation was developed to reflect the relationship between the base year zonal trip which is the dependent variable and zonal households and employment counts which are the independent variables. The equation was developed by using the "least squares" method to calculate a straight line that best fits the data for a buffer layer. The results provide the coefficient for household and employment input variables of the equation. The format of the equation is shown below.

$$\text{Trips} = A * \text{Households} + B * \text{Employment}$$

A: Households coefficient

B: Employment coefficient

Therefore, a pair of coefficients was obtained for each of the five buffer layers. The estimated coefficients for the five buffer layer are shown in the table 1.1.1. This equation was then applied to all the TAZs within each buffer layer to calculate the newly estimated zonal trips. The base and future year SE data were used to calculate the estimated trips for base and future year respectively, and the zonal growth factor was then calculated by taking the ratio of estimated future year trips to base year trips. A portion of data table for developing the zonal growth factor for zones within the study area is shown in table 1.1.2. Columns "2006 Estimates" and "2040 Estimates" show the estimated trips calculated by using the equation and the SE data for 2006 and 2040 respectively. The "Growth Factor" column shows the ratio of the 2040 estimated trips to the 2006 estimated trips.

Table 1.1.1
Coefficient for Households and Employment

TAZ Buffer Layers	Household	Employment
Study Area (32-County)	8.86	4.34
Census Tract	6.40	3.46
County	7.28	1.60
RPC	0.10	0.00
State	0.02	0.00



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Table 1.1.2
Sample Data of Zonal Growth Factors Estimate for Passenger Car

Zone	2006		2040		2006	2040	Growth Factor
	Household	Employment	Household	Employment	Estimates	Estimates	
38	996	2,362	1,102	3,574	19,102	25,308	1.32
39	1,597	336	1,767	508	15,638	17,894	1.14
40	1,151	2,106	1,273	3,186	19,366	25,142	1.30
41	1,021	1,069	1,130	1,617	13,708	17,056	1.24
42	346	1,630	383	2,466	10,152	14,112	1.39
43	1,264	4,644	1,399	7,027	31,394	42,944	1.37
44	1,140	581	1,261	879	12,644	15,014	1.19
45	470	2,296	520	3,474	14,146	19,708	1.39
46	1,792	1,061	1,983	1,605	20,518	24,576	1.20
47	1,275	1,535	1,411	2,323	17,988	22,618	1.26
48	930	2,114	1,029	3,199	17,440	23,032	1.32
49	2,168	1,323	2,399	2,002	24,994	29,994	1.20
50	1,973	642	2,183	971	20,304	23,598	1.16
51	2,164	219	2,395	331	20,162	22,700	1.13
52	1,992	2,690	2,204	4,070	29,370	37,246	1.27
53	3,142	2,211	3,477	3,345	37,498	45,398	1.21
54	2,257	300	2,498	454	21,340	24,148	1.13
55	3,013	1,053	3,334	1,593	31,322	36,518	1.17
56	2,132	1,168	2,359	1,767	24,002	28,618	1.19
57	3,199	1,159	3,540	1,754	33,434	39,046	1.17
58	1,535	2,488	1,699	3,764	24,436	31,434	1.29

The Zonal growth factors were then used in the Fratar process to create the future year trip matrix using the base year trip matrix as an input. The Fratar distribution is the process of modifying a matrix of values based upon a set of growth factors for each of the zones in the matrix. A series of iterations is performed on the base year matrix. At the end of the first iteration, each row in the matrix is factored according to its zonal growth factor. The row will match the targeted value, but the column totals will not. During the second iteration, the same technique is applied on each column. This process continues until the row and column total converge towards the target totals and the criteria for convergence is met. The resulting trip table was the forecasted future year passenger car trip table which reflects the future growth in economic activity at zonal level. The increase in the total trips for each of the five (5) TAZ buffer layers is shown in table 1.1.3. The comparison of base year and future year traffic assignment is shown in figure 1.1.1.



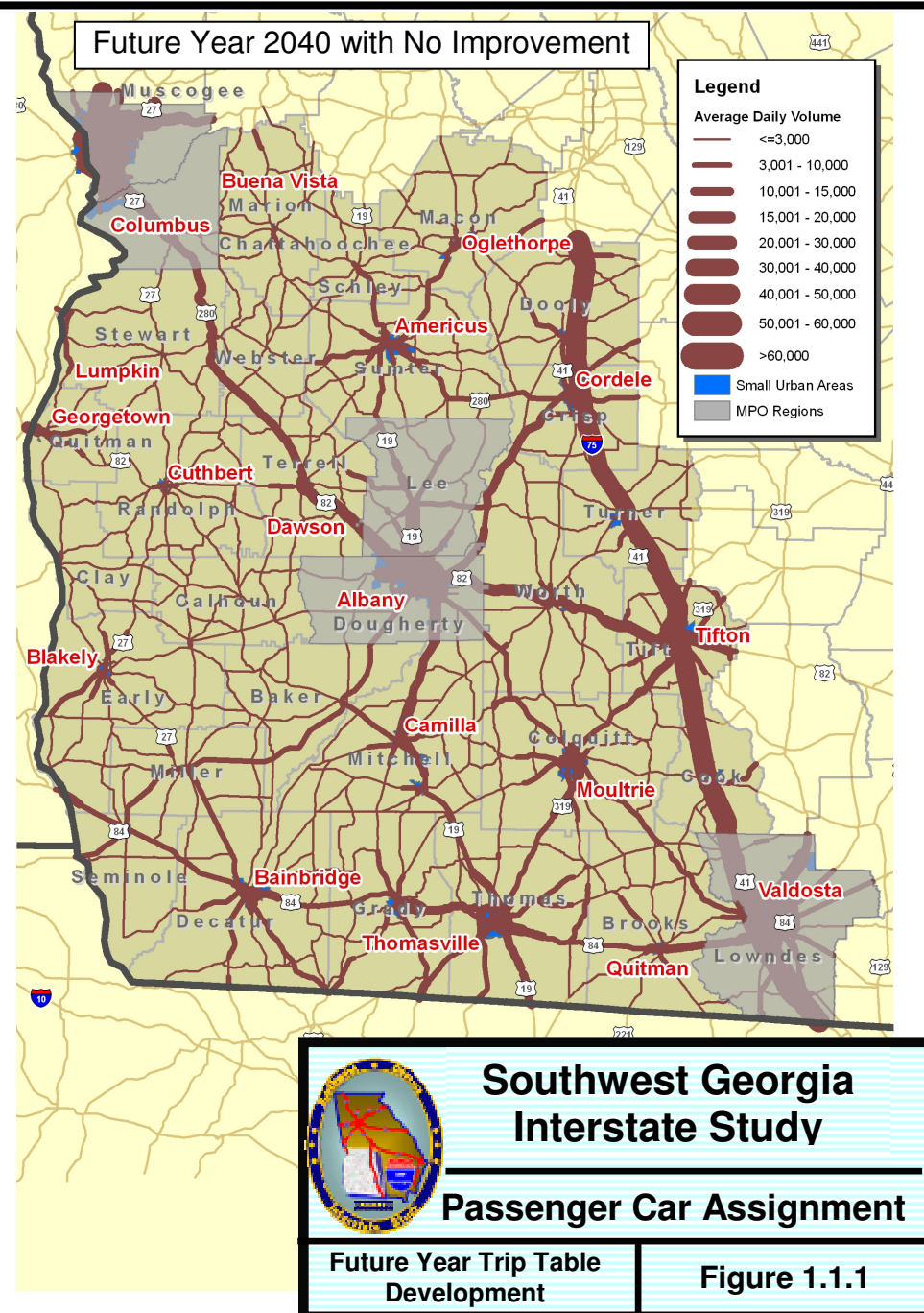
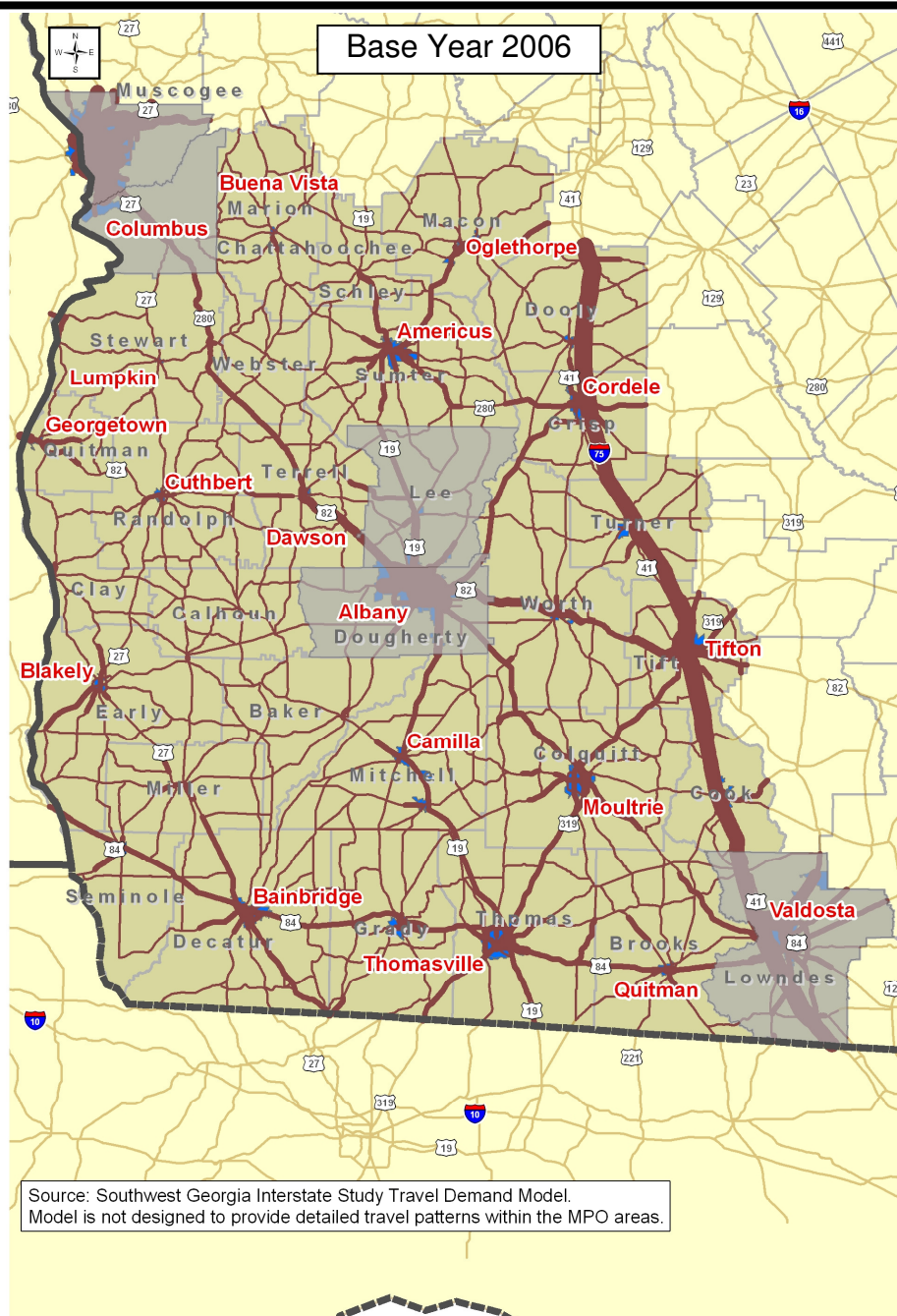
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Table 1.1.3
Passenger Car Trip Table Statistics

TAZ Buffer Layers	Base Year 2006	Future Year 2040	% Increase
Study Area (32-County)	2,568,025	3,247,347	27
Census Tract	3,925,986	5,553,094	41
County	31,066,767	46,276,206	49
RPC	779,635	1,227,663	58
State	3,562,938	4,423,112	24
Total	41,903,350	60,727,421	45





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1.2 Truck Trip Table Forecast

The base year truck trip table contains two components: short-haul local trips and long-haul freight trips. The short-haul commercial truck trips were developed in the trip generation process in a similar way that the passenger car trips were developed. The primary input for the commercial trips is the SE data of the base year. The commercial trip table was then created in the trip distribution process. The long-haul trips were developed from the FAF² database for 2006 where detailed O-D follows can be extracted. The combination of the commercial and freight trip provides a base year seeds trip table which was refined by the matrix estimation process as was done for the passenger car seeds trip table. The development of both types of trip is documented in separated Technical Memorandums. The output from the matrix estimation process is the final base year truck table which includes both commercial and freight trip. For the purpose of developing the future truck table, the base year truck table was separated into commercial and freight trip tables based on the proportion of each type of trips existed in the input seeds tables. The forecast were then performed for each of the trip components separately.

The development of future commercial truck trip table was similar to the processed used in creating the future passenger car trip table. A linear equation was developed to fit the zonal truck trips, households, and employment. But this time, only the TAZs within the study area were used to create the equation because the commercial trucks were only estimated for the study area and because the impact of local short-haul truck trips outside the study area was not considered significant on the traffic pattern within the study area. Therefore, one equation was developed for the zones within the study area. The resulting equation is shown below.

$$\text{Trips} = 1.14 * \text{Households} + 0.78 * \text{Employment}$$

Hence, the base and future year estimated trips for each zone were calculated and the growth factor for the zone were obtained from the ratio of future year trips over the base year estimated trips. Table 1.2.1 shows a portion of the worksheet used to calculate the zonal growth factor for the commercial truck trips. These growth factors were then put into the Fratar process together with the base year commercial trip table to create the future year trip table.

Unlike the commercial truck trip table, the freight trip table was developed based on each O-D pair's growth factor calculated from freight seeds tables developed from the FAF² database. Both the 2006 base and 2040 future year seeds freight truck tables were developed, and therefore, the growth factor can be obtained by calculating the ratio of future trips over the base trips. As a result, a growth factor matrix was established. The matrix was used to multiply the base freight trip table, which was separated from the base year truck trip table, to produce the future year freight trip table. The



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forecasted commercial and freight type trips were then combined into one future year truck table. Table 1.2.2 shows the truck table statistics for trips generated for each of five (5) TAZ buffer layers. The truck table assignment results comparison is shown in figure 1.2.1.

Table 1.2.1
Sample Data of Zonal Growth Factors Estimate for Truck

Zone	2006		2040		2006	2040	Growth Factor
	Household	Employment	Household	Employment	Estimates	Estimates	
34	1,177	174	1,302	263	1,488	1,702	1.14
35	112	4,361	124	6,598	3,563	5,339	1.50
36	1,552	360	1,717	545	2,065	2,400	1.16
37	1,375	356	1,522	539	1,859	2,171	1.17
38	996	2,362	1,102	3,574	3,004	4,080	1.36
39	1,597	336	1,767	508	2,098	2,428	1.16
40	1,151	2,106	1,273	3,186	2,980	3,970	1.33
41	1,021	1,069	1,130	1,617	2,014	2,571	1.28
42	346	1,630	383	2,466	1,681	2,382	1.42
43	1,264	4,644	1,399	7,027	5,109	7,140	1.40
44	1,140	581	1,261	879	1,766	2,140	1.21
45	470	2,296	520	3,474	2,348	3,333	1.42
46	1,792	1,061	1,983	1,605	2,892	3,540	1.22
47	1,275	1,535	1,411	2,323	2,672	3,449	1.29
48	930	2,114	1,029	3,199	2,732	3,701	1.35
49	2,168	1,323	2,399	2,002	3,530	4,330	1.23
50	1,973	642	2,183	971	2,770	3,270	1.18
51	2,164	219	2,395	331	2,656	3,010	1.13
52	1,992	2,690	2,204	4,070	4,405	5,735	1.30
53	3,142	2,211	3,477	3,345	5,348	6,625	1.24
54	2,257	300	2,498	454	2,827	3,225	1.14
55	3,013	1,053	3,334	1,593	4,288	5,081	1.19



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Table 1.2.2
Truck Trip Table Statistics

TAZ Buffer Layers	Base Year	Future Year	% Increase
Study Area (32-County)	477,519	613,628	29
Census Tract	24,379	38,630	59
County	568,420	1,159,127	104
RPC	289,536	520,641	80
State	1,514,438	2,927,091	93
Total	2,874,293	5,259,116	83

